AMENDMENTS TO THE SPECIFICATION

The specification has been amended as follows:

Page 1

The following new heading has been added at line 4:

BACKGROUND OF THE INVENTION

The subheading at line 5 has been amended as follows:

~~TECHNICAL FIELD~~1. Field of the Invention

The subheading at line 11 has been amended as follows:

~~BACKGROUND OF THE INVENTION~~2. Description of Related Art

The paragraph at lines 12-20 has been amended as follows:

Audio source coding techniques can be divided into two classes: natural audio coding and speech coding. Natural audio coding is commonly used for music or arbitrary signals at medium ~~bitrates~~bit rates. Speech codecs are basically limited to speech reproduction, but can on the other hand be used at very low bit rates. In both classes, the signal is generally separated into two major signal components, a spectral envelope and a corresponding residual signal. Codecs that make use of such a division exploit the fact that the spectral envelope can be coded much more efficiently than the residual. In systems where high-frequency reconstruction methods are used, no residual corresponding to the highband is transmitted. Instead, a highband is generated at the decoder

side from the lowband covered by the core codec, and shaped to obtain the desired highband spectral envelope. In double-ended HFR systems, envelope data corresponding to the upper frequency range is transmitted, whereas in single-ended HFR systems the highband envelope is derived from the lowband. In either case, prior art audio codecs apply a time invariant crossover frequency between the core codec frequency range and the HFR frequency range. Thus, at a given ~~bitrate~~bit rate, the crossover frequency is selected such that a good trade-off between core codec introduced artifacts, and HFR system introduced artifacts is achieved for typical ~~programme~~ program material. Clearly, such a static setting may be far from the optimum for a particular ~~signal:~~signal. The core codec is either overstressed, resulting in higher than necessary lowband artifacts, which inherent to the HFR method also degrades the highband quality, or not used to its full potential, ~~i.e.~~i.e., a larger than necessary HFR frequency range is employed. Hence, the maximum performance of the joint coding system is only occasionally reached by prior art systems. Furthermore, the possibility to align the crossover to transitions between regions with disparate spectral properties, such as tonal and noise like regions, is not exploited.

Page 2

The paragraph at lines 2-14 has been amended as follows:

The present invention provides a new method and an apparatus for improvement of coding systems where high frequency reconstruction methods (HFR) are used. The invention parts from the traditional usage of a fixed crossover frequency between the lowband, where conventional coding schemes (such as MPEG Layer-3 or AAC) are used, and the highband, where HFR coding schemes are used, by ~~continuos~~ continuous estimation and application of the crossover frequency that yields the optimum tradeoff between artifacts introduced by the lowband codec and the HFR system respectively. According to the invention, the choice can be based on a measure of the degree of difficulty of encoding a signal with the core codec, a short-time bit demand detection, and a spectral tonality analysis, or any combination thereof. The measure of difficulty can be derived from the perceptual entropy, or the psychoacoustically relevant core codec distortion. Since the optimum choice changes frequently over time, the application of a variable crossover frequency results in a substantially improved audio quality, which also is less dependent on program material characteristics. The invention is applicable to single-ended and double-ended HFR-systems.

The paragraph at line 21 has been amended as follows:

Fig. 1 is a graph that illustrates the terms lowband, highband and crossover ~~frequency.~~frequency;

The paragraph at line 22 has been amended as follows:

Fig. 2 is a graph that illustrates a core codec workload ~~measure.~~ measure;

The paragraph at line 23 has been amended as follows:

Fig. 3 is a graph that illustrates short time bit-demand variations of a constant ~~bitrate codec.~~bit rate codec;

The paragraph at line 24 has been amended as follows:

Fig. 4 is a graph that illustrates division of a signal into tonal and noise-like frequency ~~ranges.~~ranges;

The paragraph at line 25 has been amended as follows:

Fig. 5 is a block diagram of an HFR-based encoder, enhanced by a crossover frequency control ~~module.~~module;

The paragraph at line 26 has been amended as follows:

Fig. 6 is a block diagram, which illustrates the crossover frequency control module in ~~detail.~~detail; and

Page 3

The heading at line 1 has been amended as follows:

DETAILED DESCRIPTION OF ~~PREFERRED EMBODIMENTS~~THE PRESENT INVENTION

Page 6

The paragraph at lines 20-31 has been amended as follows:

Adapting the HFR start frequency to the varying bandwidth of the lowband signal would be a very tedious task when applying conventional transposition methods such as frequency translation. Those methods generally involve filtering of the lowband signal to extract a lowpass or bandpass signal that subsequently is modulated in the time domain, causing a frequency shift. Thus, an ~~adaption~~ adaptation would incorporate switching of lowpass or bandpass filters and changes in the modulation frequency. Furthermore, a change of filter causes discontinuities in the output signal, which impels the use of windowing techniques. However, in a filterbank-based system, the filtering is automatically achieved by extraction of subband signals from a set of consecutive filterbands. An equivalent to the time domain modulation is then obtained by means of repatching of the extracted subband signals within the filterbank. The repatching is easily adapted to the varying crossover

frequency, and the aforementioned windowing is inherent in the subband domain, so the change of translation parameters is achieved at little additional complexity.

Page 7

The paragraph at lines 13-21 has been amended as follows:

Fig. 6 gives an example of subsystems within the crossover frequency control module 504, and 601 respectively. An encoder workload measure analysis module 602 explores how difficult the current frame is to code for the core encoder, using for example the perceptual entropy or the distortion energy approach as described above. Provided that the core codec employs a bit reservoir, a buffer fullness analysis module may be ~~included, 603~~includes. The buffer fullness analysis module is shown as bit demand module 63 in Fig. 6. A tonality analysis module, 604, signals a target crossover frequency corresponding to the tonal/noise transition frequency when applicable. All input parameters to the joint decision module 606 are combined and balanced according to the actual implementation of the used core- and HFR-codecs when calculating the crossover frequency to use, in order to obtain the maximum overall performance.